This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(8 + 2i)(-9 + 7i)$$

The solution is $-86 + 38i$, which is option E.

A. $a \in [-59, -55]$ and $b \in [-78, -72]$

$-58 - 74i$, which corresponds to adding a minus sign in the second term.

B. $a \in [-73, -63]$ and $b \in [11, 16]$

$-72 + 14i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

C. $a \in [-87, -85]$ and $b \in [-44, -36]$

$-86 - 38i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-59, -55]$ and $b \in [74, 77]$

$-58 + 74i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-87, -85]$ and $b \in [34, 41]$

* $-86 + 38i$, which is the correct option.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

---

2. Simplify the expression below and choose the interval the simplification is contained within.

$$3 - 2^2 + 1 \div 10 * 18 \div 11$$

The solution is -0.836, which is option D.

A. $[-1.12, -0.9]$

-0.999, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[7.09, 7.26]$

7.164, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

C. $[6.71, 7.11]$

7.001, which corresponds to two Order of Operations errors.

D. $[-0.85, -0.3]$

* -0.836, this is the correct option

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

---

3. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{1188}{9}} + \sqrt{45}i$$

The solution is Nonreal Complex, which is option B.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

B. Nonreal Complex

* This is the correct option!

C. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

D. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

---

4. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{625}{0}} + \sqrt{45}i$$

The solution is Not a Complex Number, which is option D.

A. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

B. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

D. Not a Complex Number

* This is the correct option!

E. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

---

5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-9 - 33i}{-7 + 5i}$$

The solution is $-1.38 + 3.73i$, which is option B.

A. $a \in [-103.5, -101]$ and $b \in [3, 4.5]$

$-102.00 + 3.73i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-3, -1]$ and $b \in [3, 4.5]$

* $-1.38 + 3.73i$, which is the correct option.

C. $a \in [-3, -1]$ and $b \in [275.5, 276.5]$

$-1.38 + 276.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [1.5, 4]$ and $b \in [2, 3]$

$3.08 + 2.51i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [0.5, 1.5]$ and $b \in [-8, -6.5]$

$1.29 - 6.60i$, which corresponds to just dividing the first term by the first term and the second by the second.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

---

6. Simplify the expression below and choose the interval the simplification is contained within.

$$6 - 3^2 + 19 \div 5 * 10 \div 2$$

The solution is 16.000, which is option B.

A. $[33.31, 34.53]$

34.000, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

B. $[15.92, 16.33]$

* 16.000, this is the correct option

C. $[14.78, 15.26]$

15.190, which corresponds to two Order of Operations errors.

D. $[-2.93, -1.92]$

-2.810, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

---

7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-7 - 8i)(3 + 10i)$$

The solution is $59 - 94i$, which is option B.

A. $a \in [56, 63]$ and $b \in [93, 97]$

$59 + 94i$, which corresponds to adding a minus sign in both terms.

B. $a \in [56, 63]$ and $b \in [-96, -92]$

* $59 - 94i$, which is the correct option.

C. $a \in [-103, -100]$ and $b \in [-46, -40]$

$-101 - 46i$, which corresponds to adding a minus sign in the first term.

D. $a \in [-24, -16]$ and $b \in [-85, -73]$

$-21 - 80i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

E. $a \in [-103, -100]$ and $b \in [46, 47]$

$-101 + 46i$, which corresponds to adding a minus sign in the second term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

---

8. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-72 - 66i}{3 + 4i}$$

The solution is $-19.20 + 3.60i$, which is option C.

A. $a \in [-25, -23.5]$ and $b \in [-17.5, -15.5]$

$-24.00 - 16.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-20.5, -19]$ and $b \in [89.5, 91]$

$-19.20 + 90.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [-20.5, -19]$ and $b \in [3, 5]$

* $-19.20 + 3.60i$, which is the correct option.

D. $a \in [1.5, 2]$ and $b \in [-20, -19]$

$1.92 - 19.44i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [-481, -479]$ and $b \in [3, 5]$

$-480.00 + 3.60i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

---

9. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{23}{0}}$$

The solution is Not a Real number, which is option A.

A. Not a Real number

* This is the correct option!

B. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

D. Irrational

These cannot be written as a fraction of Integers.

E. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{\frac{23}{0}}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

---

10. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{256}{625}}$$

The solution is Rational, which is option B.

A. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

B. Rational

* This is the correct option!

C. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

D. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\frac{16}{25}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

---

11. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(10 - 4i)(-6 - 8i)$$

The solution is $-92 - 56i$, which is option D.

A. $a \in [-38, -25]$ and $b \in [-104, -102]$

$-28 - 104i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-38, -25]$ and $b \in [104, 108]$

$-28 + 104i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-92, -87]$ and $b \in [52, 57]$

$-92 + 56i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-92, -87]$ and $b \in [-56, -54]$

* $-92 - 56i$, which is the correct option.

E. $a \in [-63, -58]$ and $b \in [28, 35]$

$-60 + 32i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

---

12. Simplify the expression below and choose the interval the simplification is contained within.

$$12 - 8 \div 13 * 16 - (15 * 14)$$

The solution is -207.846, which is option C.

A. $[-202.04, -193.04]$

-198.038, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[-182.85, -176.85]$

-179.846, which corresponds to not distributing a negative correctly.

C. $[-213.85, -203.85]$

* -207.846, which is the correct option.

D. $[219.96, 223.96]$

221.962, which corresponds to not distributing addition and subtraction correctly.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

---

13. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-567}{9}}i + \sqrt{55}i$$

The solution is Nonreal Complex, which is option C.

A. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

B. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

C. Nonreal Complex

* This is the correct option!

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

---

14. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{\sqrt{119}}{20} + \sqrt{-6}i$$

The solution is Irrational, which is option C.

A. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

B. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

C. Irrational

* This is the correct option!

D. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

---

15. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{45 - 22i}{7 - 4i}$$

The solution is $6.20 + 0.40i$, which is option A.

A. $a \in [6.04, 6.3]$ and $b \in [-0.5, 1]$

* $6.20 + 0.40i$, which is the correct option.

B. $a \in [6.04, 6.3]$ and $b \in [25.5, 28]$

$6.20 + 26.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

C. $a \in [402.98, 403.23]$ and $b \in [-0.5, 1]$

$403.00 + 0.40i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [3.36, 3.52]$ and $b \in [-6, -4.5]$

$3.49 - 5.14i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [6.28, 6.6]$ and $b \in [5, 6]$

$6.43 + 5.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

---

16. Simplify the expression below and choose the interval the simplification is contained within.

$$9 - 4^2 + 16 \div 18 * 7 \div 17$$

The solution is -6.634, which is option D.

A. $[25.34, 26.01]$

25.366, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

B. $[-7.31, -6.88]$

-6.993, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[24.16, 25.14]$

25.007, which corresponds to two Order of Operations errors.

D. $[-6.66, -6.5]$

* -6.634, this is the correct option

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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17. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(6 - 3i)(7 - 10i)$$

The solution is $12 - 81i$, which is option E.

A. $a \in [36, 44]$ and $b \in [28, 35]$

$42 + 30i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

B. $a \in [9, 14]$ and $b \in [80, 82]$

$12 + 81i$, which corresponds to adding a minus sign in both terms.

C. $a \in [66, 75]$ and $b \in [-40, -38]$

$72 - 39i$, which corresponds to adding a minus sign in the first term.

D. $a \in [66, 75]$ and $b \in [38, 47]$

$72 + 39i$, which corresponds to adding a minus sign in the second term.

E. $a \in [9, 14]$ and $b \in [-81, -77]$

* $12 - 81i$, which is the correct option.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

---

18. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-63 + 33i}{-6 + 2i}$$

The solution is $11.10 - 1.80i$, which is option C.

A. $a \in [7.5, 8.5]$ and $b \in [-9, -7]$

$7.80 - 8.10i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [10, 11]$ and $b \in [15.5, 17]$

$10.50 + 16.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [11, 12]$ and $b \in [-2.5, -0.5]$

* $11.10 - 1.80i$, which is the correct option.

D. $a \in [443, 445]$ and $b \in [-2.5, -0.5]$

$444.00 - 1.80i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [11, 12]$ and $b \in [-73.5, -71.5]$

$11.10 - 72.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

---

19. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{102400}{256}}$$

The solution is Integer, which is option B.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

B. Integer

* This is the correct option!

C. Irrational

These cannot be written as a fraction of Integers.

D. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

E. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -320.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

---

20. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{14}{0}}$$

The solution is Not a Real number, which is option C.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

B. Irrational

These cannot be written as a fraction of Integers.

C. Not a Real number

* This is the correct option!

D. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

E. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{\frac{14}{0}}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

---

21. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-6 + 4i)(9 - 3i)$$

The solution is $-42 + 54i$, which is option C.

A. $a \in [-42, -38]$ and $b \in [-56, -50]$

$-42 - 54i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-68, -58]$ and $b \in [16, 19]$

$-66 + 18i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-42, -38]$ and $b \in [52, 59]$

* $-42 + 54i$, which is the correct option.

D. $a \in [-68, -58]$ and $b \in [-18, -16]$

$-66 - 18i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-55, -49]$ and $b \in [-16, -6]$

$-54 - 12i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

---

22. Simplify the expression below and choose the interval the simplification is contained within.

$$20 - 17^2 + 7 \div 18 * 19 \div 8$$

The solution is -268.076, which is option D.

A. $[-269.87, -268.41]$

-268.997, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[309.82, 310.51]$

309.924, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

C. $[308.54, 309.06]$

309.003, which corresponds to two Order of Operations errors.

D. $[-268.96, -267.02]$

* -268.076, this is the correct option

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

---

23. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{12}{14} + \sqrt{-9}i$$

The solution is Rational, which is option D.

A. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

B. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

C. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

D. Rational

* This is the correct option!

E. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

---

24. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$-\sqrt{\frac{225}{121}} + 16i^2$$

The solution is Rational, which is option D.

A. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

B. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

C. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

D. Rational

* This is the correct option!

E. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

---

25. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{63 - 22i}{-1 + 3i}$$

The solution is $-12.90 - 16.70i$, which is option A.

A. $a \in [-13, -12.5]$ and $b \in [-17.5, -16]$

* $-12.90 - 16.70i$, which is the correct option.

B. $a \in [-64.5, -62.5]$ and $b \in [-9, -5.5]$

$-63.00 - 7.33i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-13, -12.5]$ and $b \in [-169, -166]$

$-12.90 - 167.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-130, -128]$ and $b \in [-17.5, -16]$

$-129.00 - 16.70i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [-0.5, 1.5]$ and $b \in [20, 22.5]$

$0.30 + 21.10i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

---

26. Simplify the expression below and choose the interval the simplification is contained within.

$$20 - 19 \div 14 * 6 - (16 * 17)$$

The solution is -260.143, which is option D.

A. $[-70.43, -63.43]$

-70.429, which corresponds to not distributing a negative correctly.

B. $[-255.23, -247.23]$

-252.226, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[291.77, 293.77]$

291.774, which corresponds to not distributing addition and subtraction correctly.

D. $[-262.14, -258.14]$

* -260.143, which is the correct option.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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27. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(9 - 6i)(2 - 8i)$$

The solution is $-30 - 84i$, which is option B.

A. $a \in [-34, -28]$ and $b \in [81, 88]$

$-30 + 84i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-34, -28]$ and $b \in [-86, -81]$

* $-30 - 84i$, which is the correct option.

C. $a \in [66, 68]$ and $b \in [60, 67]$

$66 + 60i$, which corresponds to adding a minus sign in the second term.

D. $a \in [66, 68]$ and $b \in [-64, -55]$

$66 - 60i$, which corresponds to adding a minus sign in the first term.

E. $a \in [17, 23]$ and $b \in [48, 55]$

$18 + 48i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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28. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{45 - 66i}{7 - i}$$

The solution is $7.62 - 8.34i$, which is option C.

A. $a \in [4, 6]$ and $b \in [-10.5, -9.5]$

$4.98 - 10.14i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [5.5, 7]$ and $b \in [65, 66.5]$

$6.43 + 66.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [6.5, 8]$ and $b \in [-9, -6.5]$

* $7.62 - 8.34i$, which is the correct option.

D. $a \in [380, 382]$ and $b \in [-9, -6.5]$

$381.00 - 8.34i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [6.5, 8]$ and $b \in [-417.5, -416]$

$7.62 - 417.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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29. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{-715}{5}}$$

The solution is Not a Real number, which is option D.

A. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

B. Irrational

These cannot be written as a fraction of Integers.

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

D. Not a Real number

* This is the correct option!

E. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{143}i$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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30. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{38025}{169}}$$

The solution is Whole, which is option E.

A. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

B. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

D. Irrational

These cannot be written as a fraction of Integers.

E. Whole

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 195.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.
